What is claimed is:

1. A method for manufacturing a capacitor bottom electrode of a semiconductor device, the method comprising the steps of:

a) preparing a semiconductor substrate obtained by a predetermined process;

b) forming a sacrificial layer of low k dielectric material on the semiconductor substrate;

c) forming a photoresist pattern on the sacrificial layer;

d) etching the sacrificial layer by using the photoresist pattern as an etching mask, thereby forming an opening;

e) depositing a conductive layer on sides and a bottom face of the opening and a top face of the sacrificial layer;

f) forming a photoresist on the conductive layer, wherein a concave region of the conductive layer is completely filled with the photoresist;

g) planarizing the conductive layer till a top face of the sacrificial layer is exposed; and

h) forming a bottom electrode by removing the sacrificial layer enclosing the bottom electrode by using O_2 plasma and by removing a residual photoresist.

2. The method as recited in claim 1, wherein the step h) is carried out by using O_2 plasma with plasma gas selected from the group consisting of N_2, H_2, CF_4 and NF_3.

3. The method as recited in claim 1, wherein the conductive layer uses a material selected from the group consisting of tungsten, tungsten silicide, titanium nitride, polysilicon and the combination thereof by using an atomic layer deposition (ALD) method.

4. The method as recited in claim 1, wherein the step g) is carried out by using excited plasma having basic gas of Cl_2 and supplementary gas of O_2.

5. The method as recited in claim 1, wherein the step g) is carried out by using excited plasma having basic gas of BCl_3 and supplementary gas of O_2.

6. The method as recited in claim 1, wherein the step g) is carried out by using excited plasma having basic gas of SF_6/N_2 gas and supplementary gas of O_2.

7. The method as recited in claim 1, wherein the bottom electrode has a shape of cylindrical type.